

## EE416A: Opto Electronics (Jan 2018)

**Lecture room and time:** L-3 | Tue and Thurs 5:10-6:25 pm

**Instructor:** Shilpi Gupta | office: ACES-224 | email: ShilpiG@iitk.ac.in | phone: 6231

**Office hour:** ACES-224, Thurs 4-5 pm

### Syllabus

#### 1. *Review of semiconductor physics*

Energy bands in solids, E-k diagrams, Density of states, Occupation probability, Fermi level, p-n junction, Schottky junction, Ohmic contacts; Semiconductor materials of interest, Bandgap engineering, quantum wells.

#### 2. *Light-semiconductor interaction*

Emission- and absorption rates, stimulated emission, optical signal amplification

#### 3. *Semiconductor light sources*

LED and laser: Basic structure, theory and device characteristics; various types of lasers and their modulation schemes; Semiconductor optical amplifiers.

#### 4. *Semiconductor photodetectors*

Various types of photodetectors: Basic structure, theory and characteristics. Loss and noise mechanisms. Solar cells and CCDs. Integrated circuits.

#### 5. *Overview of current research efforts:* nanophotonic devices.

### References

*Recommended:*

1. J. Singh, *Semiconductor Optoelectronics: Physics and Technology*, McGraw-Hill Inc. (1995).

2. B. E. A. Saleh and M. C. Teich, *Fundamentals of Photonics*, John Wiley & Sons, Inc., (2007).

*Other useful books:*

3. A. Yariv and P. Yeh, *Photonics: Optical Electronics in Modern Communications*, Oxford University Press, New York (2007).

4. P. Bhattacharya, *Semiconductor Optoelectronic Devices*, Prentice Hall of India (1997).

5. Online course: *Semiconductor Optoelectronics* by M R Shenoy on NPTEL.

### Marks Distribution

We will follow a continuous evaluation system that will enable steady learning and alleviate dependence of overall grade on few events.

- Quizzes: 30%
- Mid-sem exam: 30%
- Journal club: 10%
- End-sem exam: 30%

### Quizzes

1. A quiz every two weeks at the beginning of the class on Tuesdays (~6 quizzes).

*Tentative dates:* Jan 16, Jan 30, Feb 13, Mar 20, Apr 3, and Apr 17

2. Best n-1 out of n quizzes will count towards grade.

3. No makeup option for a missed quiz.

### Journal Club

Towards the end of the course, students in groups of 2-4 will read few journal papers on the topic of their choice (aligned with the course structure and discussed with the instructor in advance), and present it to the class (15 minute talk). The presenter will be picked randomly from the group, and therefore, everyone in the group is expected to work

on the project. We will do this exercise in first 30-40 minutes of the last few classes, and the content covered in the talks will also be a part of the syllabus for the final exam.

### **Exams**

1. Exams will cover the entire portion of the syllabus covered till the exam day.
2. If mid-semester exam is missed with prior permission of the instructor, the final will carry 60% (mid-sem + final) weight. But please keep in mind that the final will cover the entire syllabus of the course, and therefore will be tougher.
3. There will be no makeup option for a missed final exam, except for unavoidable circumstances in which case prior discussion with the instructor is necessary.
4. Reevaluation of answer sheets will be done only if correct solution has been marked incorrect. No requests for more/mercy marks will be entertained. If during reevaluation, more mistakes are found in the solution, marks can be deducted.

### **Cheating/Unethical Practices**

Cheating/Unethical means are NOT ACCEPTABLE in any part of the course (quizzes, journal club and exams). Such cases, if any, will be dealt with strict punishment: administrative action and/or lowering of grade.

### **Attendance**

No weightage of attendance on grades.

### **Grading**

No mercy pleas for better grades will be entertained.

### **Communication and Interaction**

1. The communication for the course will happen through emails and Piazza. Please feel free to contact the instructor.
2. Please make use of the office hours and the discussion forum on Piazza to discuss your doubts.